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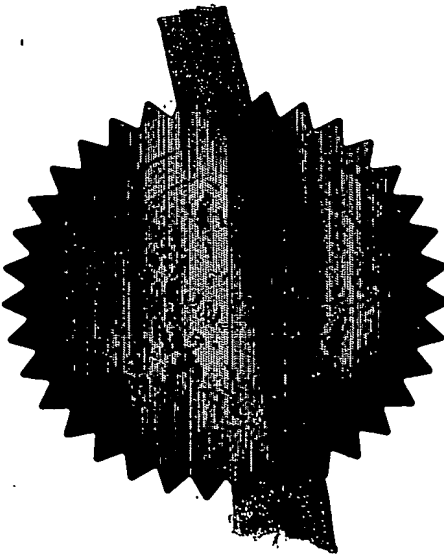
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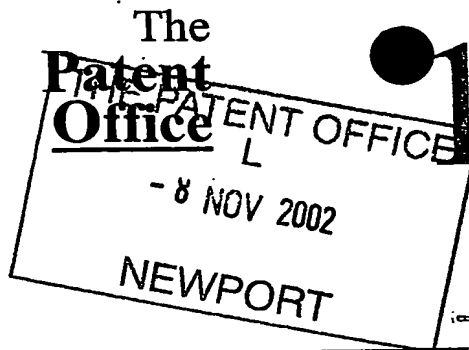
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1.	Your reference	CDK 2045	08NOV02 E762121-9 D02806
2.	Patent application number (The Patent Office will fill in this part)	0226101.4	P01/7700 0.00-0226101.4
3.	Full name, address and postcode of the or of each applicant (<u>underline all surnames</u>)	Rhodia Consumer Specialties Limited Trinity Street Oldbury West Midlands B69 4LN	
	Patents ADP number (if you know it)	7870322005	
	If the applicant is a corporate body, give the country/state of its incorporation	England	
4.	Title of the invention	WHITE RUST CORROSION INHIBITORS	
5.	Name of your agent (if you have one)	Barker Brettell	
	"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)	138 Hagley Road Edgbaston Birmingham B16 9PW	
	Patents ADP number (if you know it)	7442494002	
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7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application	Date of filing (day/month/year)
8.	Is a statement of inventorship and of right to grant of a patent required in support of this request (Answer 'Yes' if: a) any applicant named in part 3 is not an inventor, or b) there is an inventor who is not named as an applicant, or c) any named applicant is a corporate body. See note (d))	YES	

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Description 9 + 9 ✓

Claim(s) 4 + 4 ✓

Abstract - *DM*

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0. If you are also filing any of the following, state how many against each item.

Priority documents -

Translations of priority documents -

Statement of inventorship and right to grant of a patent (*Patents Form 7/77*) -

Request for preliminary examination 1
(*Patents Form 9/77*)

Request for substantive examination -
(*Patents Form 10/77*)

Any other documents -
(*please specify*)

1. I/We request the grant of a patent on the basis of this application.

Signature
Barker Brettell
Barker Brettell

Date
07 November 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

C D Kinton

Tel: 0121 456 1364

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WHITE RUST CORROSION INHIBITORS

This invention relates to corrosion inhibitors and in particular to corrosion inhibitors for use in systems where water is used. The present invention especially relates to a compound for use as a white rust corrosion inhibitor and to a composition including such a compound.

Many of the components of water using systems are made of steel, which has been galvanised with zinc or cadmium by various processes, including hot dip. This is done in order to minimise corrosion of the steel. Zinc is the most commonly used metal for galvanising steel.

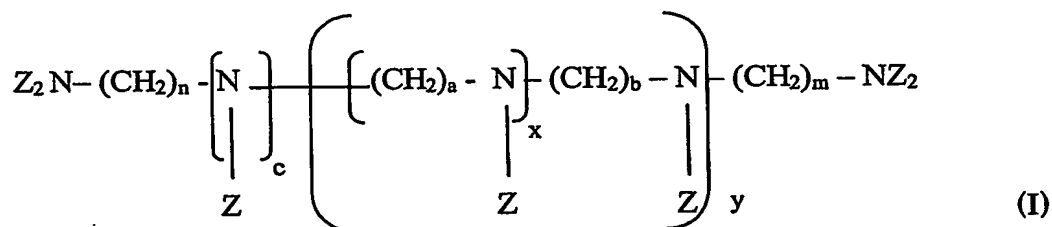
The zinc plating protects the steel from corrosion. However, the zinc plating reacts with the atmosphere and with water to produce "white rust" which comprises a variety of zinc compounds including, zinc oxide, zinc carbonates and the like. Under these corrosive conditions the zinc coating may not be able to protect the base steel and thus corrosion of the steel may occur reducing the life expectancy of the system. White rust is therefore problematic in water using industries utilising galvanised steel systems. This has been recognised in the industry (as is shown, for example in "White Rust: An Industry update and Guide Paper" published by the Association of Water Technologies, 2002). However, current philosophy in the industry is to concentrate on the treatment and removal of white rust after it has formed, and/or on its avoidance by selecting construction materials which are not susceptible to its formation.

Hitherto, no corrosion inhibitor currently used in water using systems has been found which is able to inhibit effectively the formation of "white rust".

It is an object of the present invention to provide a compound and a composition, each of which is effective for inhibiting "white rust" formation and for ameliorating the problem of corrosion caused by "white rust" in systems that have been galvanised with relatively electropositive metals such as zinc or cadmium, especially with zinc.

The applicant has found that the addition, to water using systems, of certain phosphonated oligomers or of random copolymers of vinylidene diphosphonic acid and vinyl sulphonic acid, or of compositions including such compounds, achieves the aforementioned object.

Accordingly, the present invention provides in a first aspect a compound for use as, or in connection with, a white rust corrosion inhibitor for water-treatment, said compound consisting of an organophosphonate having the general formula (I):



Wherein

$Z = -CHR_1PO_3R_2$

$R = H, CH_3, C_2H_5$ or M

$R^1 = H, CH_3, CR_3, C_6H_5$, or SO_3H_2

$M =$ alkali metal or ammonium ion

$n = 0$ to 6

$m = 0$ to 6

$a = 0$ to 6

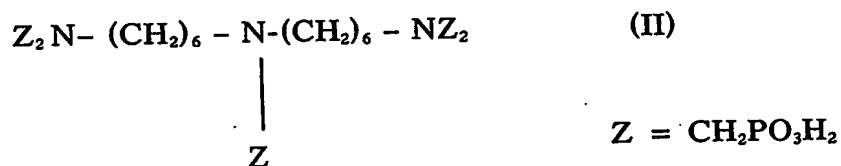
$b = 0$ to 6

$c = 0$ or 1

x = 0 to 6

y = 0 to 6

In a particularly preferred embodiment of the present invention R and R'
 5 each = H, n = 6, m = 6, c = 1, y = 0 whereby the compound is
 bis(hexamethylene)triamine-pentakis (methylene phosphonic acid), as in
 formula (II):



10

In a second aspect, the present invention provides a compound for use as
 a white rust corrosion inhibitor for water-treatment, said compound being
 a random copolymer of vinylidene diphosphonic acid and vinyl sulphonic
 15 acid in a molar ratio of between 1:1 and 1:500, suitably about 1:100
 molar and preferably about 1:20 molar.

In a third aspect the present invention provides a composition for use as,
 or in connection with a corrosion inhibitor for water-treatment, said
 20 composition comprising a phosphonated oligomer according to the first
 aspect or a random copolymer of vinylidene diphosphonic acid and vinyl
 sulphonic acid, according to the second aspect, together with additives
 conventionally used in the water treatment industry. The additives may
 include scale inhibitors such as phosphonates, corrosion inhibitors such as
 25 phosphonocarboxylic acids or salts and/or dispersants such as
 polyacrylates. The composition may optionally incorporate a biocide.

In a fourth aspect, the present invention provides a method for inhibiting corrosion in, or in connection with, a water-using system, said method consisting of the application or addition to said system of an effective amount of a phosphonated oligomer according to the first aspect or a
 5 random copolymer of vinylidene diphosphonic acid and vinyl sulphonic acid according to the second aspect or of a composition according to the third aspect.

Preferably, in the method according to the fourth aspect of the present
 10 invention, the oligomer or co-polymer or composition is used in an effective amount of up to 1000 ppm suitably up to 250 ppm, for example up to 100 ppm

The phosphonocarboxylic acid or salt is preferably a phosphonated
 15 oligomer of maleic acid, of general formula (III):



wherein M is a cation such that the oligomer is soluble in water, and n is
 20 greater than 1. Such phosphonated oligomer's are disclosed in the applicant's EP-B-0491391 and equivalent publications and are available from the applicant as BRICORR® 288.

The polyacrylate compound is preferably a low molecular weight (MW)
 25 polymer, e.g. MW = 2000-5000. However, it is to be understood that other molecular weight ranges can be used.

The present invention will now be illustrated, merely by way of example,
 as follows.

Methodology

Test Water

Two test waters were used in the Examples herein below. The relevant
5 properties of the test waters are shown in Table 1 (below).

TABLE I

	Water 1 (Soft)	Water 2 (Hard)
Calcium Hardness (ppm as CaCO_3)	0	340
Alkalinity (ppm as CaCO_3)	500	300
Chloride ion (ppm)	150	50
pH	9	9

10 The waters shown in TABLE 1 (above) are known to be corrosive to galvanised steel.

Test Method

The corrosion testing was carried out on a Rotating Coupon Rig. Each
15 Rig holds 2 coupons. The test water was aerated and the galvanised steel coupons (50 X 25mm) rotated at 150-160rpm. Water losses due to evaporation were replaced with de-ionised water daily.

20 All inhibitors used in the Examples (below) were weighed out on an analytical balance and added directly to the test water. The (pre-weighed) galvanised steel coupons were then rotated for 7 days at 40°C, cleaned to remove any corrosion deposits with warm (70-80°C) ammonium acetate

solution and then rinsed with water and acetone. The galvanised steel coupons were then oven dried and re-weighed.

EXAMPLES A TO E

- 5 The corrosion-inhibiting properties of six compounds or compositions according to the present invention were assessed by subjecting galvanised steel coupons to the test method described herein above. Also included for comparison are results from tests using phosphonates that are conventionally used as steel corrosion inhibitors (examples G, H and I).
- 10 The result are shown in TABLE II (below):

TABLE II

Inhibitor used (see notes below)	Inhibitor Level (ppm)	0 Ca ⁺⁺ Water (Soft)	340 Ca ⁺⁺ Water (Hard)
		Corrosion Rate (% of control)	Corrosion Rate (% of Control)
Control	0	100	100
Example (A)	100	20	59.2
Example (B)	100	12	89.2
Example (C)	100	15	93.3
Example (D)	100	14	115
Example (E)	100	20	44.2
Example (F)	100	-	51
Example (G)	100	196	131
Example (H)	100	112	-
Example (I)	100	82	-

Notes to TABLE II

- 5 (A) a (random copolymer of Vinylidene Diphosphonic Acid (VDPA) and Vinyl Sulphonic Acid (VSA) in a 1:20 molar ratio) available from the applicant as ITC 1028;
- 10 (B) a 23% w/w neutral solution of the potassium salt of hexamethylene diamine tetrakis(methylenephosphonic acid), available from the applicant as BRIQUEST ® 462;
- (C) a 25% w/w, neutral, aqueous solution of a sodium salt of pentaethylenhexamine-octakis (methylenephosphonic acid), available from the applicant as BRIQUEST ® 8106-25S;
- 15 (D) a 30% w/w aqueous solution of a sodium salt of N, N-bis (3-aminopropyl)amine-hexakis (methylenephosphonic acid), available from the applicant as BRIQUEST ® 684-30S;
- 20 (E) a 40% w/w aqueous solution of bis(hexamethylene)triamine pentakis(methylenephosphonic acid), available from the applicant as BRIQUEST ® 5123-45A.
- 25 (F) a mixture of BRIQUEST ® 5123-45A with 100ppm of a formulation containing water treatment polymers and a phosphonated oligomer of maleic acid, available from the applicant as BRICORR ® 288C.
- (G) BRICORR ® 288C on its own.
- 30 (H) a 60% w/w aqueous solution of 1-hydroxyethane-1,1-diphosphonic acid available from the applicant as BRIQUEST ® ADPA-60A

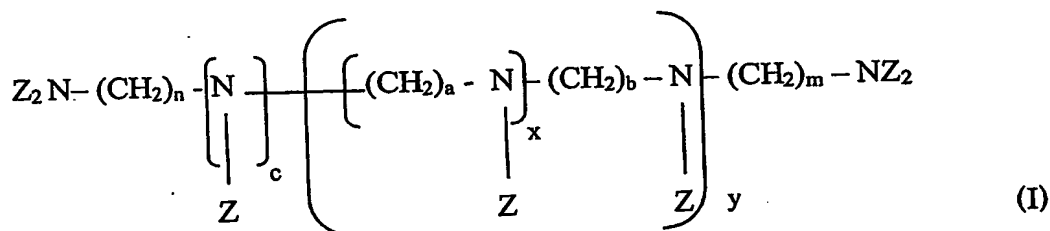
- (I) a 50% w/w aqueous solution of Nitrilotris(methylenephosphonic acid) available from the applicant as BRIQUEST® 301-50A

5 It will be apparent from TABLE I that inhibitor (E) gives the best all-round performance.

7rt80

CLAIMS

1. A compound for use as, or in connection with, a white rust corrosion inhibitor for water-treatment, said compound consisting of an organophosphonate having the general formula (I):



Wherein

$Z = -CHR_1PO_3R_2$

$R = H, CH_3, C_2H_5$ or M

10 $R^1 = H, CH_3, CR_3, C_6H_5$, or SO_3H_2

$M =$ alkali metal or ammonium ion

$n = 0$ to 6

$m = 0$ to 6

$a = 0$ to 6

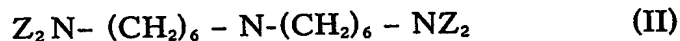
15 $b = 0$ to 6

$c = 0$ or 1

$x = 0$ to 6

$y = 0$ to 6

- 20 2. A compound as claimed in Claim 1, in which R and R^1 each = H , $n = 6$, $m = 6$, $c = 1$, $y = 0$ whereby the compound is bis(hexamethylene)triamine-pentakis (methylene phosphonic acid), as in formula (II):



3. A compound for use as a white rust corrosion inhibitor for water-treatment, said compound being a random copolymer of vinylidene diphosphonic acid and vinyl sulphonic acid in a molar ratio of
5 between 1:1 and 1:500.
4. A compound as claimed in Claim 3, in which the molar ratio is 1:100 molar.
- 10 5. A compound as claimed in Claim 3 or Claim 4, in which the molar ratio is 1:20 molar.
6. A composition for use as, or in connection with a corrosion inhibitor for water-treatment, said composition comprising a
15 phosphonated oligomer according to Claim 1 or a random copolymer of vinylidene diphosphonic acid and vinyl sulphonic acid, according to Claim 2, together with additives conventionally used in the water treatment industry.
- 20 7. A composition as claimed in Claim 6 in which the additives are selected from the group consisting of phosphonocarboxylic acids or salts and dispersants.
8. A composition as claimed in Claim 6 or Claim 7 in which the
25 dispersant is a polyacrylate.

9. A composition as claimed in any one of Claims 6 to 8 in which the composition comprises a biocide.

10. A composition as claimed in any one of Claims 6 to 9 in which the
5 phosphnocarboxylic acid or salt is a phosphonated oligomer of maleic acid, of general formula (III):



10 wherein M is a cation such that the oligomer is soluble in water, and n is greater than 1.

11. A composition as claimed in any one of Claims 6 to 9, in which the
15 polyacrylate compound is a low molecular weight polymer having a molecular weight between 2000 to 5000.

12. A method for inhibiting corrosion in, or in connection with, a water-using system, said method consisting of the application or addition to said system of an effective amount of a phosphonated oligomer
20 according to Claim 1 or a random copolymer of vinylidene diphosphonic acid and vinyl sulphonic acid according to Claim 2 or of a composition according to Claim 3.

13. A method as claimed in Claim 12, in which the oligomer or
25 copolymer is used in an effective amount of up to 1000 ppm.

14. A method as claimed in Claim 12 or Claim 13, in which the oligomer or copolymer is used in an effective amount of up to 250 ppm.

30 15 A method as claimed in any one of Claims 12 to 14 in which the oligomer or copolymer is used in an effective amount of up to 100 ppm.

16. A compound for use as or in connection with, a white rust corrosion inhibitor substantially described herein with reference to the general formula.

5 17. A compound for use as a white rust corrosion inhibitor for water treatment substantially as described herein.

18. A composition for use as, or in connection with, a corrosion inhibitor for water treatment substantially as described herein.

10

19. A method for inhibiting corrosion, or in connection with a water-using system substantially as described herein.

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